1884MNRAS..44..234N

If

$$(\alpha)\quad s=a+\left(24^{\mathrm{h}}+\frac{n}{15}\right)t$$

is Bessel's expression, I *can* certainly transfer t into t' time as follows. Let

$$nt=(n+\delta n)t',$$

then

$$(\beta)\quad s=a+\frac{n+\delta n}{15}\,.\,t'+24^{\mathrm{h}}\left(1+\frac{\delta n}{n}\right).\,t'\,,$$

Le Verrier's expression adopted in 1864 was

$$(\gamma)\quad s=a+\frac{n+\delta n}{15}\,.\,t'+24^{\mathrm{h}}.\,t'.$$

The addition of the term

$$24^{\mathrm{h}}.\,\frac{\delta n}{n}\,.\,t'$$

makes, therefore (γ) identical with (β), and it can, therefore, be re-transferred identically back into (α). This term is, therefore, the necessary correction to make the mean times deduced from Le Verrier's expression identical with those which would have been obtained from the continued use of Bessel's expression. And since the change from Bessel's expression to Le Verrier's in 1864 was an arbitrary act of astronomers, the discordances thus introduced between Hansen's Lunar Tables and observations are the results of our own action, and have nothing whatever to do with physical causes; and what we require to estimate is the *effect of the change*, and this is what I have done.

I am perfectly at a loss to understand the opposition with which my work has been received. It appears to be considered that there is some absolute physical necessity for the use of the true mean solar day as the unit of time in practical astronomy, although such a use is absolutely impossible for the reasons which I have already given.

Questions respecting Mr. Stone's Theory of Changes in the Mean Solar Day.

By Prof. Simon Newcomb.

I have refrained from joining in the discussion of Mr. Stone's views respecting the mean solar day found in the *Monthly Notices* of May last for two reasons. One is that the matter seemed too elementary in its character to be the subject of prolonged discussion. The other was a desire to wait until Mr. Stone should give a statement of his views sufficiently explicit to admit of their correctness being tested by practical application. As the discussion has now been going on for the greater part of a year, the first of these reasons has ceased to be operative. At the same time I note with surprise that Mr. Stone still refrains

Downloaded from http://mnras.oxfordjournals.org/ by guest on June 15, 2015

© Royal Astronomical Society • Provided by the NASA Astrophysics Data System

1884MNRAS..44..234N

from any such statement of his theory as would guide one in making any practical application of it, and therefore ask permission to point out what is wanted. In doing this I do not wish to be considered as taking any ground against his conclusions, but rather as viewing him in the light of a plaintiff who has failed to make a sufficiently explicit statement of his case.

On page 336 of volume xliii. of the *Monthly Notices* Mr. Stone gives a formula for the apparent deviation of the Moon's mean longitude arising from the cause which he claims to act. This expression contains the algebraic symbol t in the product $0''\cdot747\ t$, where it is understood that t is the time in years counted from *some* epoch. But neither here nor in any of his subsequent papers, so far as I have found, does he give any general definition of this epoch. Again, on the next page he gives observed corrections of the Moon's mean longitude. But he does not state what his computed corrections for the same dates would be, and thus does not afford the means of determining, even by induction, the epoch of t.

It is apparently implied that the epoch is that at which Le Verrier's tables were introduced into the British *Nautical Almanac.* But here again we must remark that no statement is made to the effect that the introduction of tables into an Ephemeris constitutes a definable epoch in the application of the tables. The same lack of general definition and explicit statement pervades all of Mr. Stone's statements on the subject which I have been able to find. As it is of great interest to all investigators of the lunar theory to know to what extent their work is to be modified should his views be proved correct, I submit the following questions respecting the application of his theory in the spirit of a seeker after information, and with the earnest hope that either Mr. Stone or someone else who has mastered his theory will answer them:—

I. What is the *general* definition of the epoch of t in the expression already alluded to on page 336?

II. What are the theoretical deviations of the Moon's mean longitude arising respectively from the introduction of Le Verrier's tables into the *Nautical Almanac* in 1864, and of Hansen's tables, the mean motion of which is substantially identical with that of Leverrier into the American *Ephemeris* in 1858?

III. On what principle or by what rules are Professor Airy's conclusions respecting the errors of Damoiseau's lunar tables and my conclusions in § 15 of *Researches on the Motion of the Moon* respecting the corrections to Hansen's tables to be modified?

IV. In lieu of this last statement any general formula or precept showing completely by what numbers and on what principles the necessary modifications are to be made, would be acceptable.

Downloaded from http://mnras.oxfordjournals.org/ by guest on June 15, 2015

© Royal Astronomical Society • Provided by the NASA Astrophysics Data System